2002 Analyst Meeting

November 7, 2002

Bill Siegle

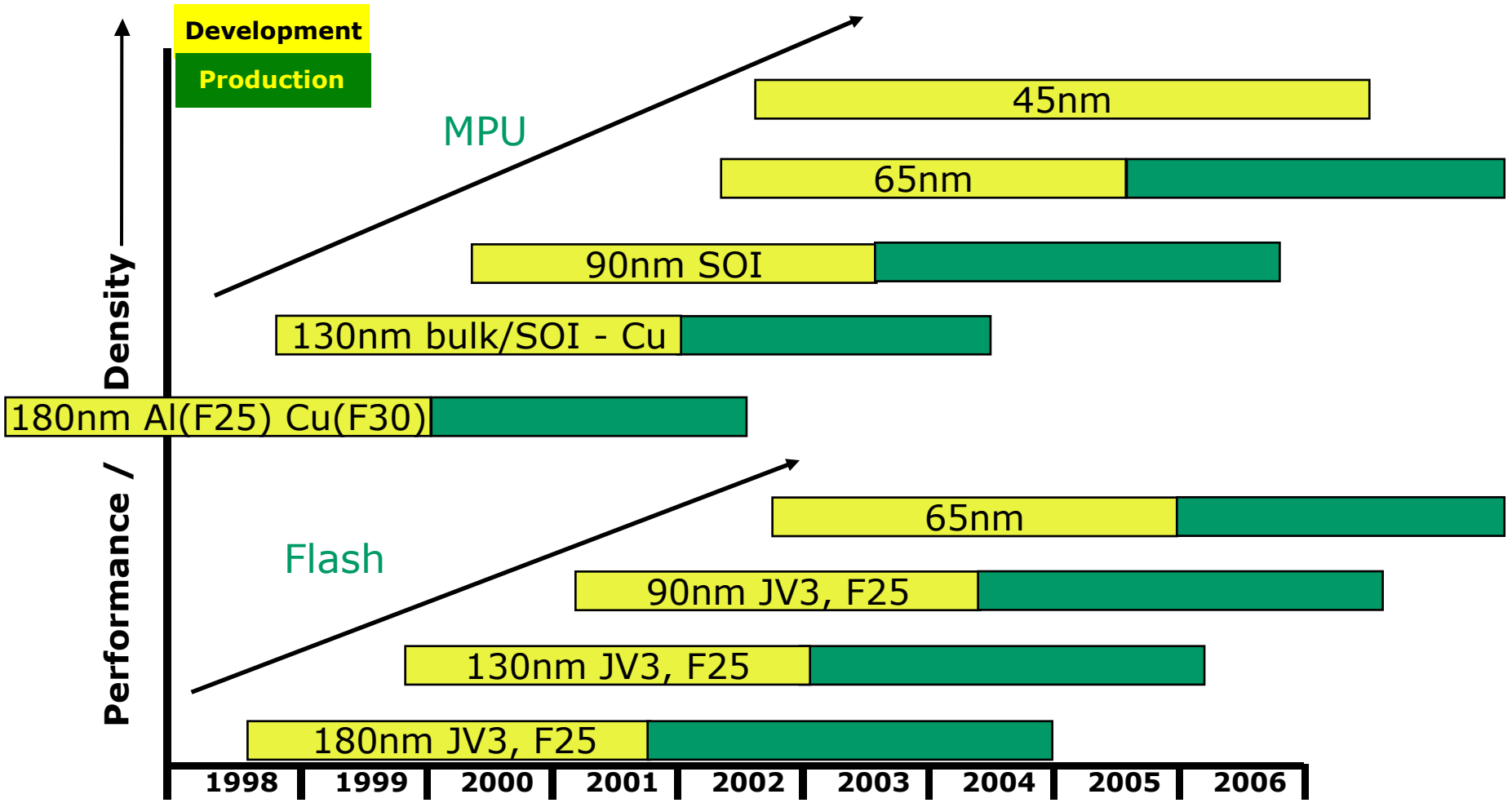
SVP, Technology Operations and Chief Scientist

November 7, 2002

2002 to 2006+ Strategy

- 130nm
  - Complete Fab30 transition to 130nm by 3Q'02 – Done
  - Prepare for 130nm Flash introduction in JV3, F25
- 90nm
  - Qualify Hammer on 90nm (HiP8) in 2H03 (Fab30)
  - Fully convert Fab30 to 90nm by 2H'04
  - Initiate 90nm flash production in 2H04
- 65nm
  - Initial development on 200mm now
  - Shift logic development to 300mm during 2003
  - Qualify first production by 2H05, both logic and flash
- 45nm
  - Research projects underway

Technology Roadmap

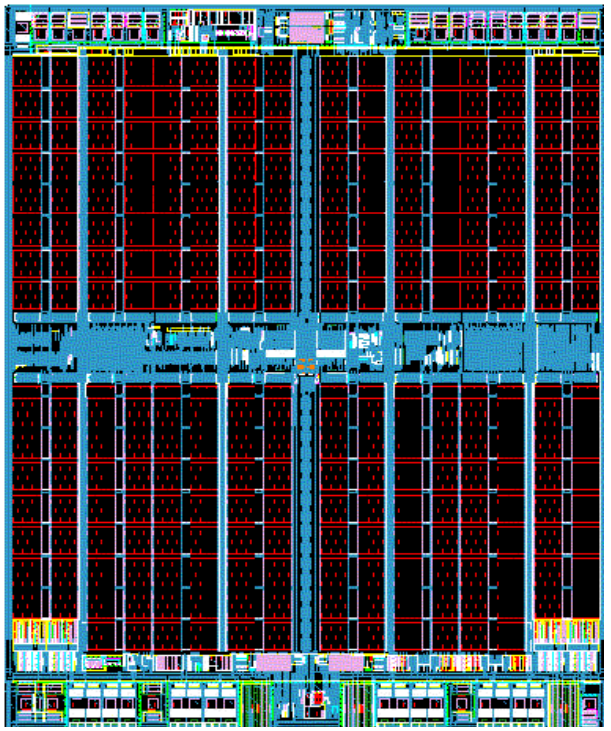


Memory Technology

130nm Flash

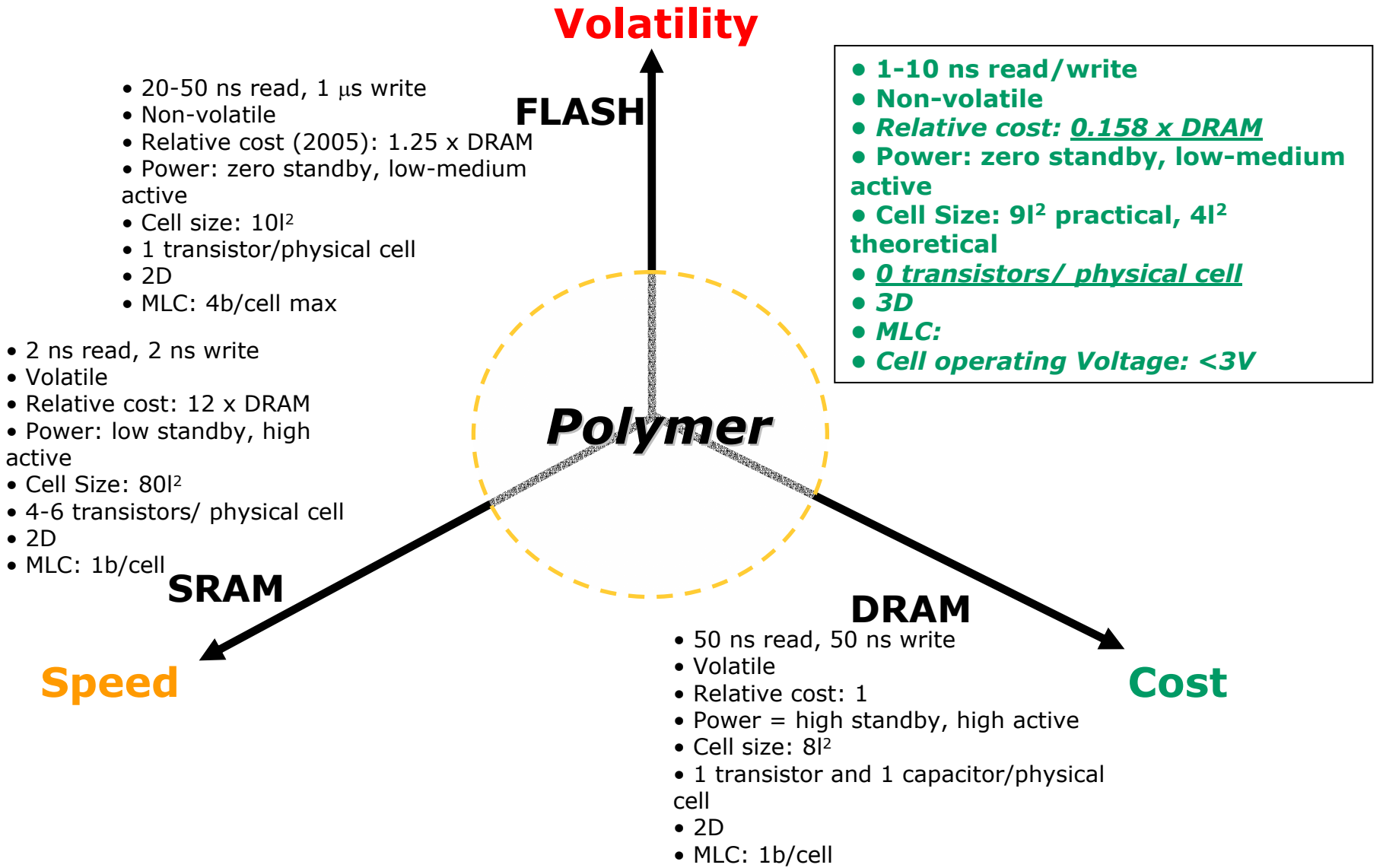
- CS69 130nm Flash Memory
  - Technology Development in Sunnyvale
  - Parallel release to manufacturing in F25 (Austin) and JV3 (Aizu)
  - Production ship Q1
- 130nm Mirror Bit
  - Production ship 2H'03
- 90nm in development
  - Production in 2004

1.8v AMD 64Mb Burst

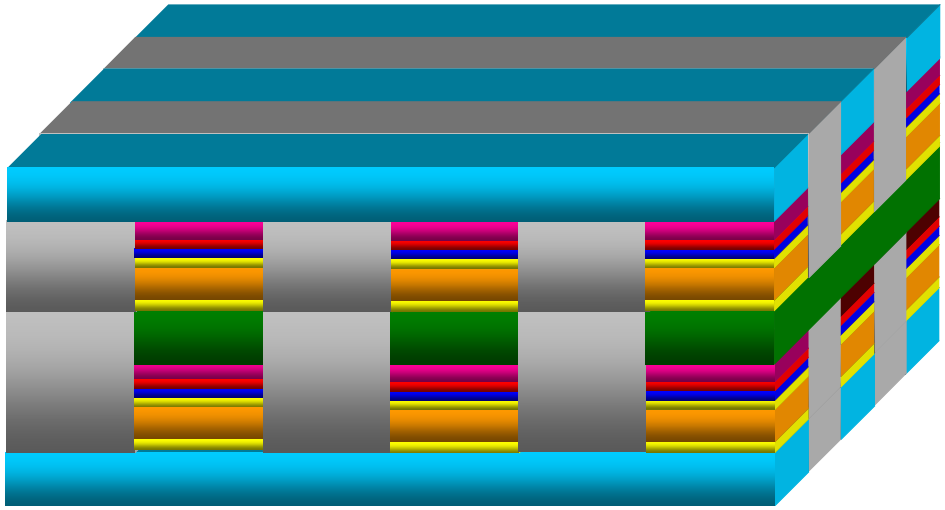


CS69

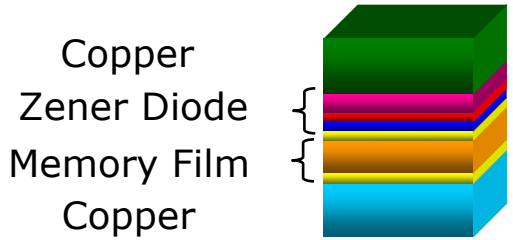
The Ultimate Memory Solution?

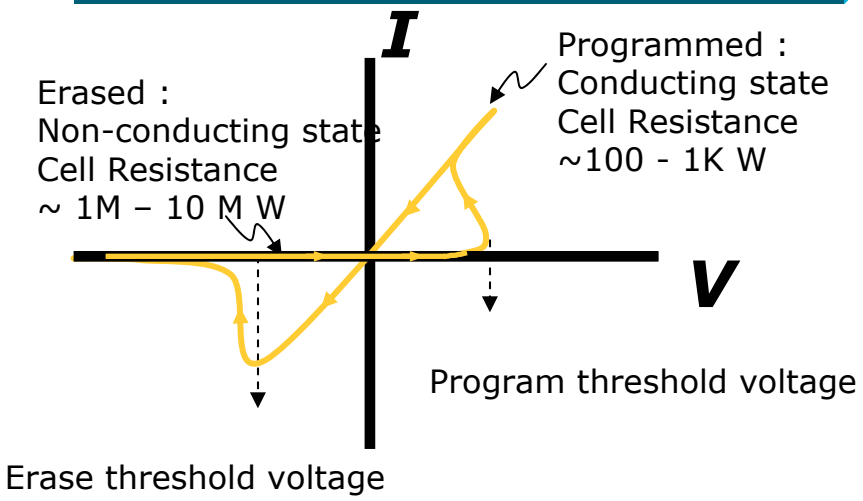


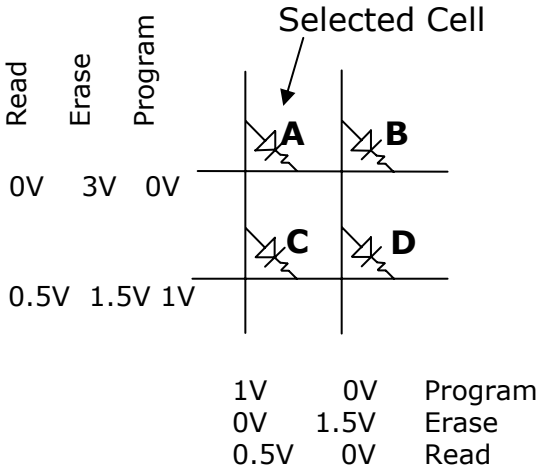
Cell and Array Cross-section



Memory Cell

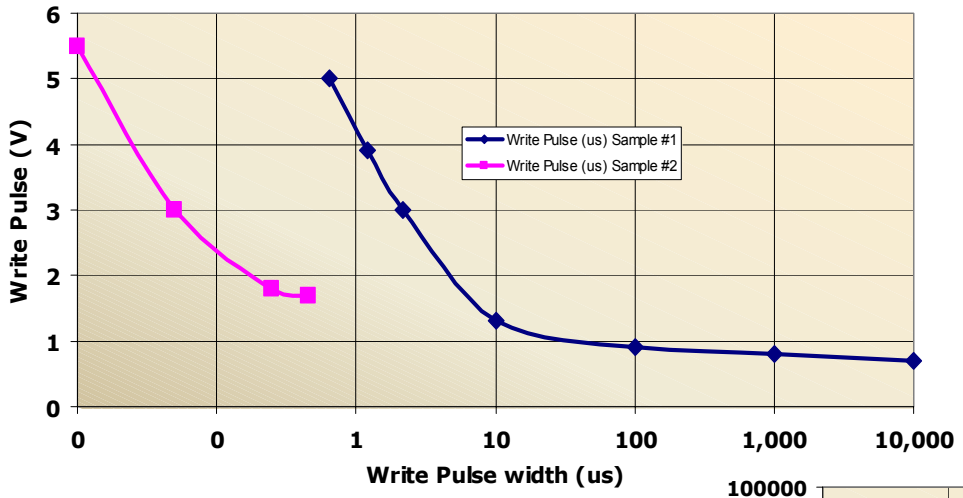




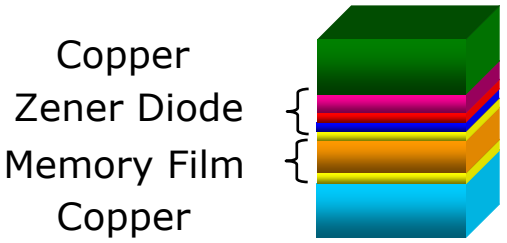


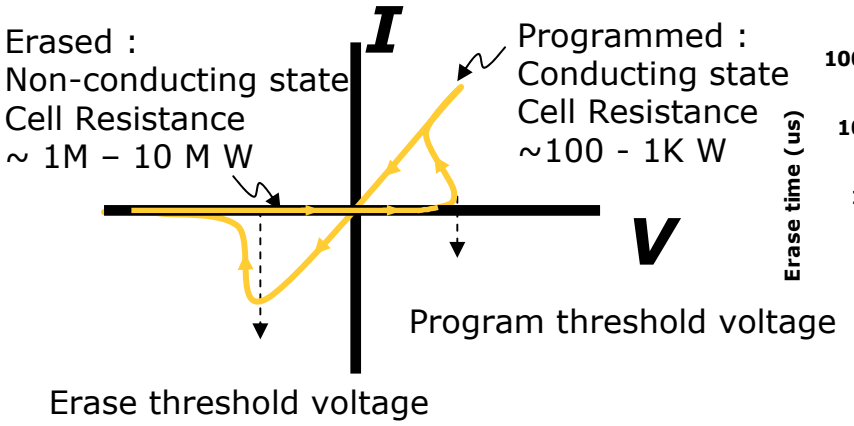
Write Speed vs. Voltage

Write Pulse (us) vs. Voltage

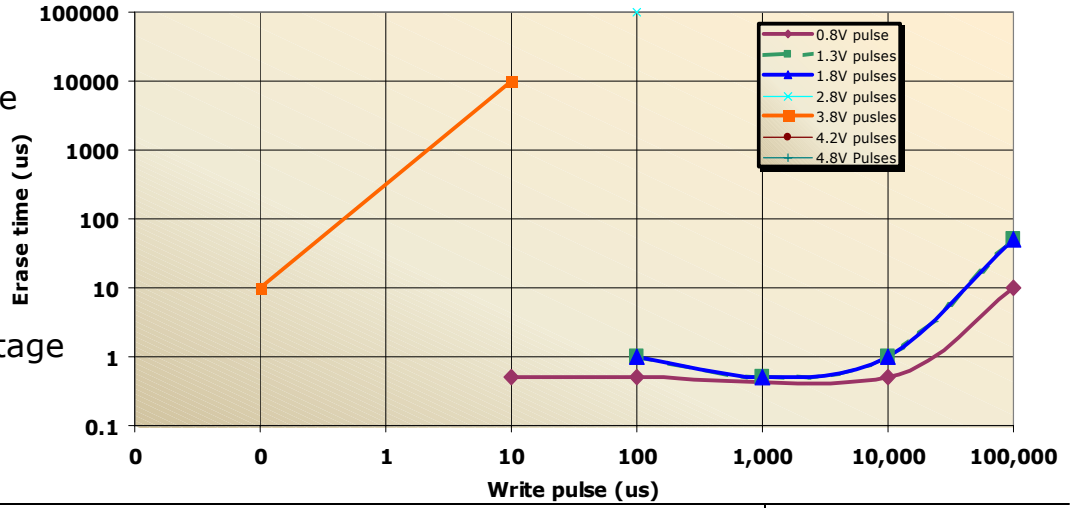


Memory Cell





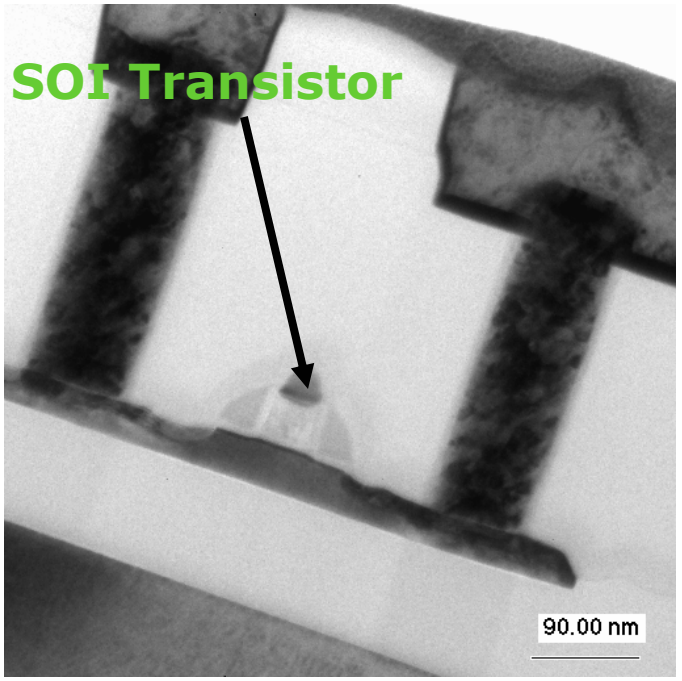
Erase time vs. Write pulse



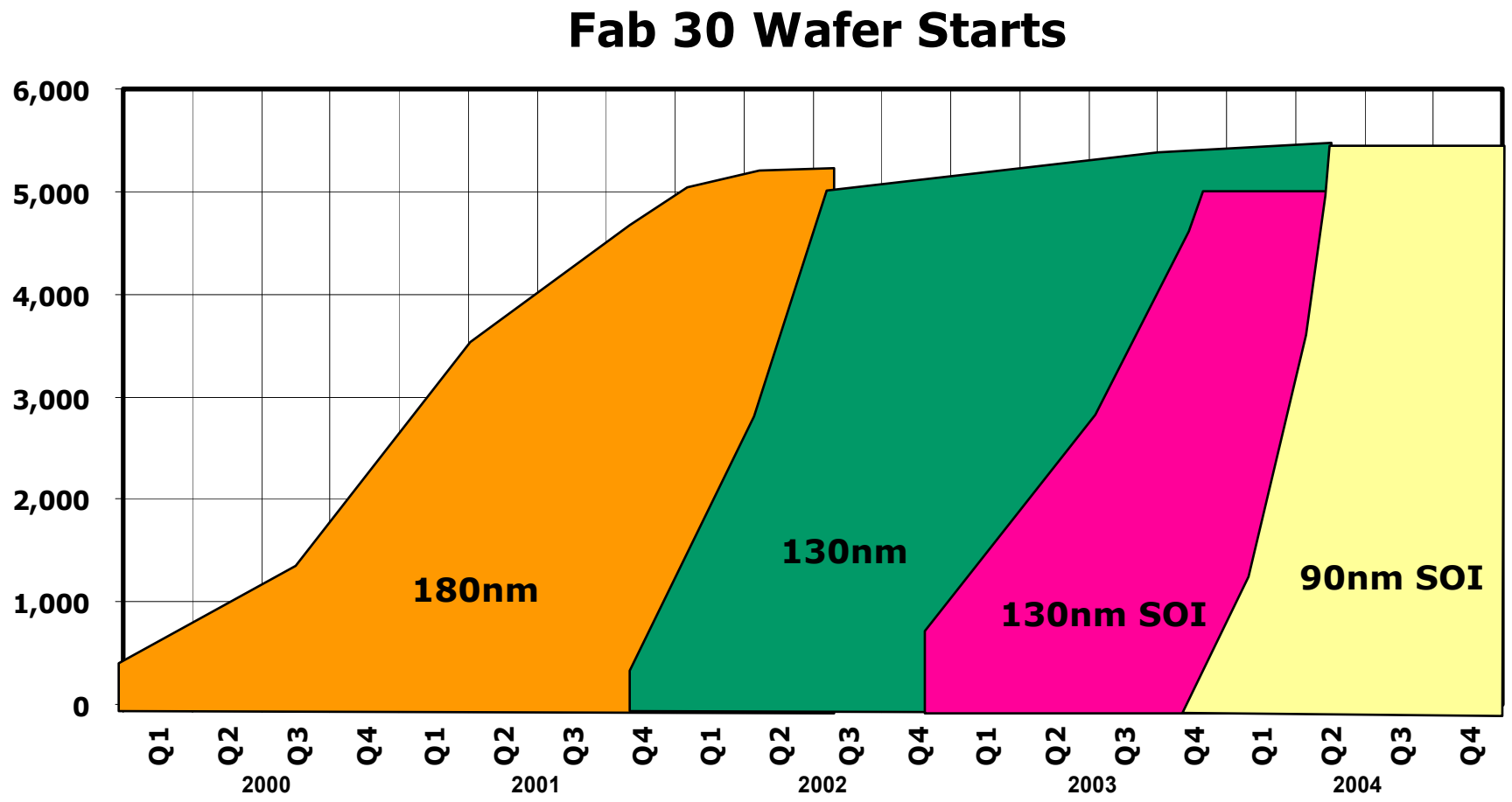
Logic Technology

Logic – 2002

- F30, Dresden
  - 100% converted to 130nm for Athlon production
  - Running >5000 w/wk
  - Preparing for SOI based Hammer family introduction



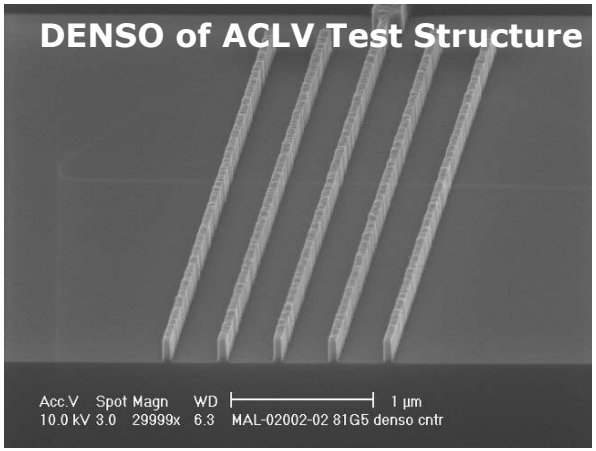
Fab30 Wafer Start Migration – 2000-04

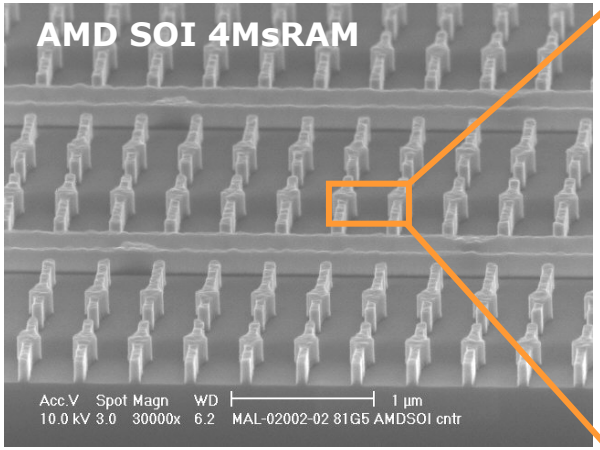


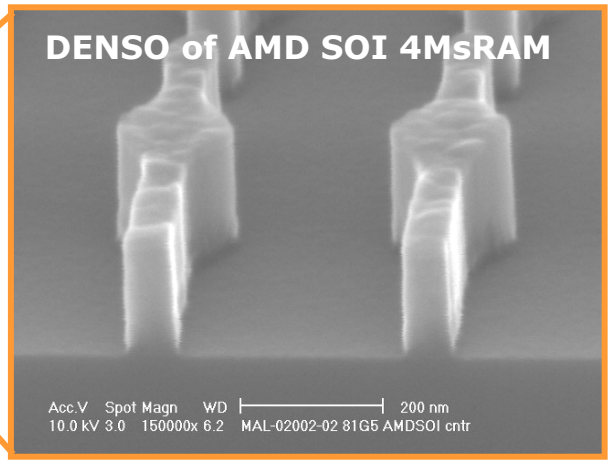
HiP8 90nm Status

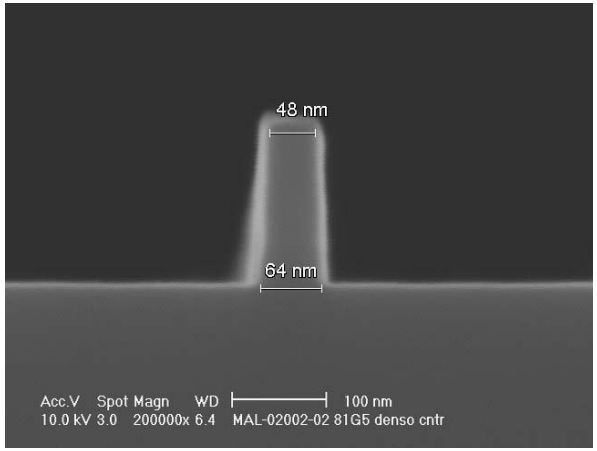
- Early development carried out in AMD/Motorola Alliance in Austin
- Activity transferred to Dresden, Fab30 in 2Q02
- Technology development vehicle (4Mb SRAM) running today in Fab
- Initial SledgeHammer vehicle now in tape-out

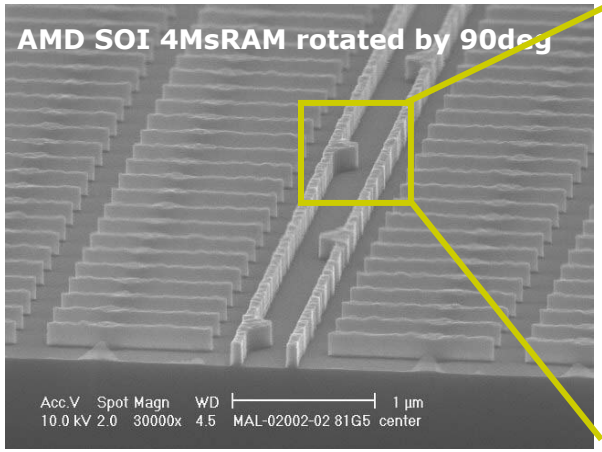
90nm SRAM Gate patterning: SEM

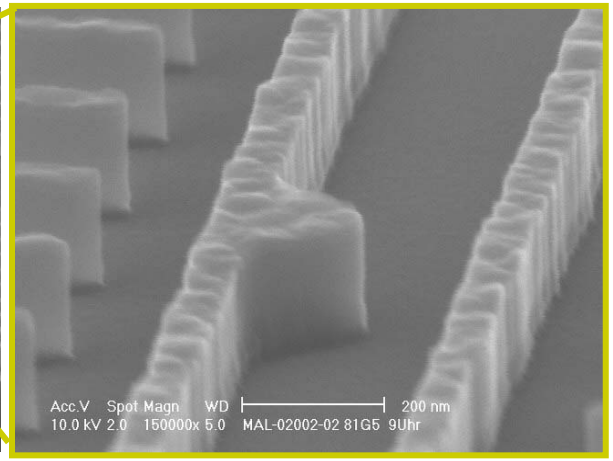




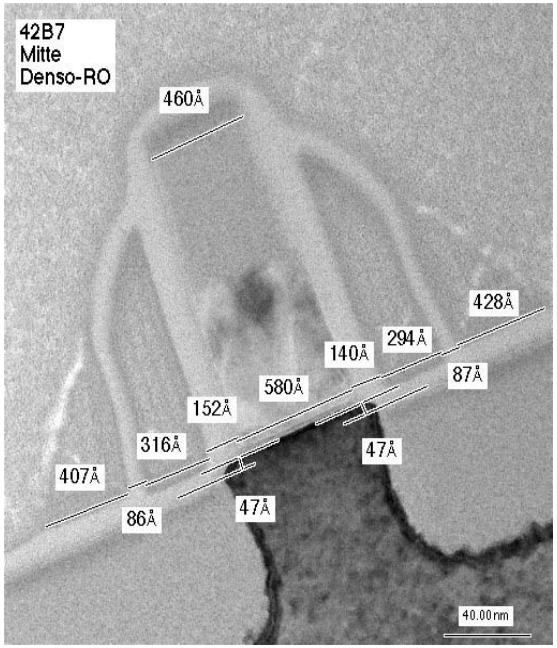


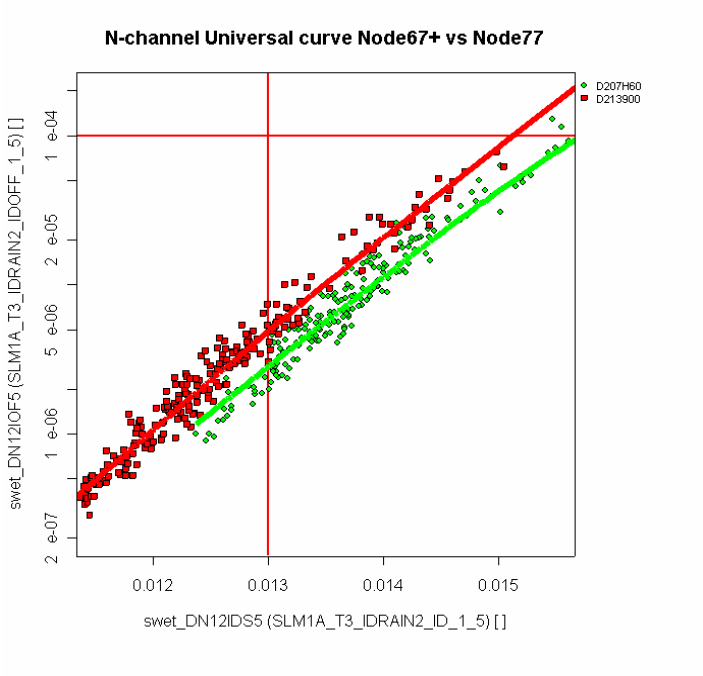






Improved speed with triple spacer

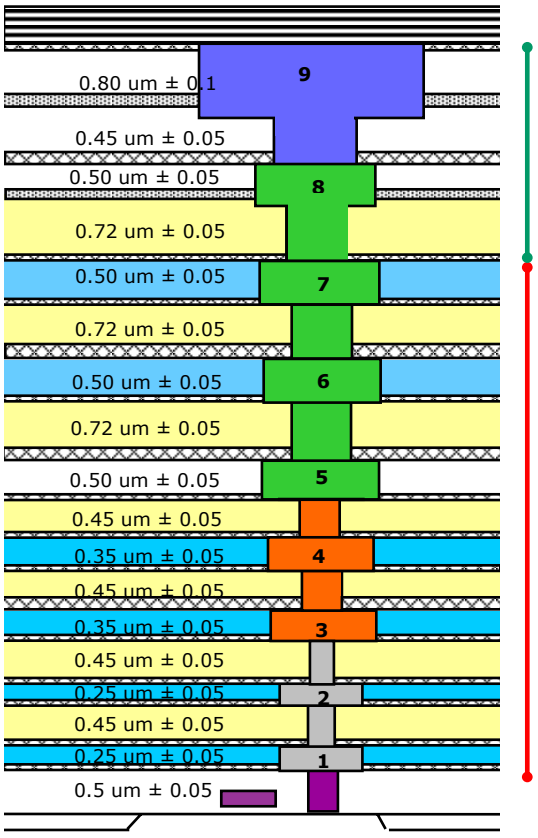




- "Triple Spacer" concept provides improved transistor performance,

BEOL Evolution 130nm through 90nm

- 130nm starting BEOL
- Currently running in F30



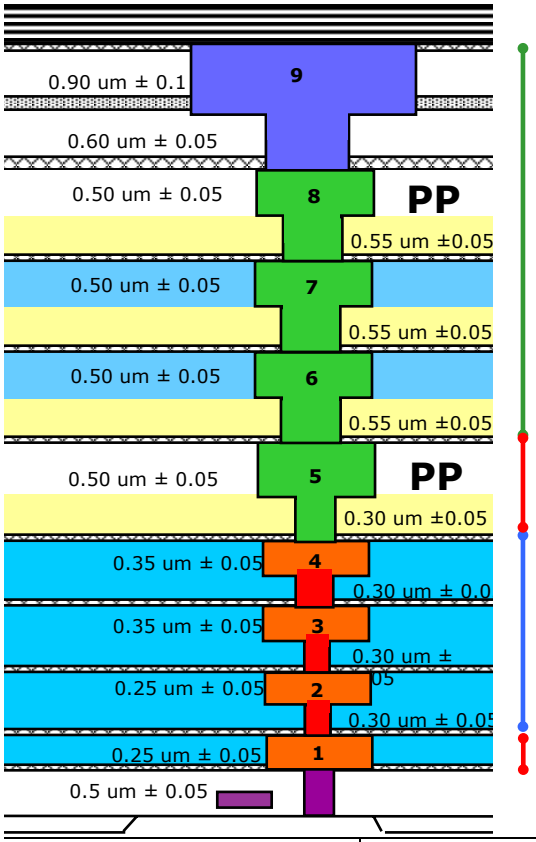
Lo k

$F\text{-}SiO_2$

E-stop

SiO_2

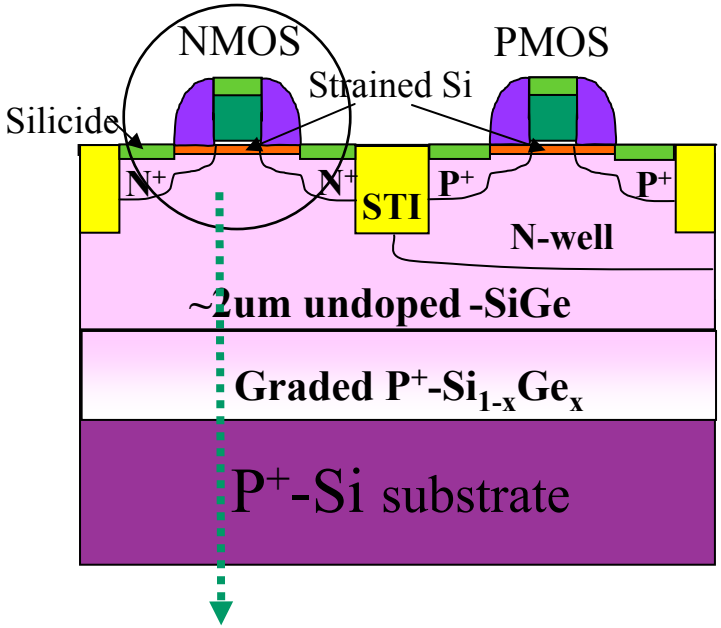
- Improved interconnect stack for 90nm
- Technology ready by 12/2002
- Production in 2H/2003

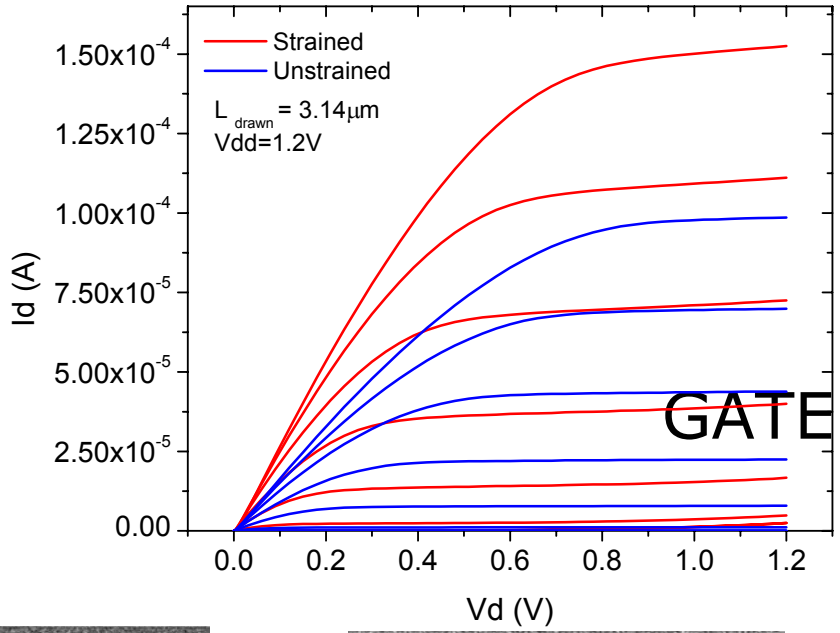


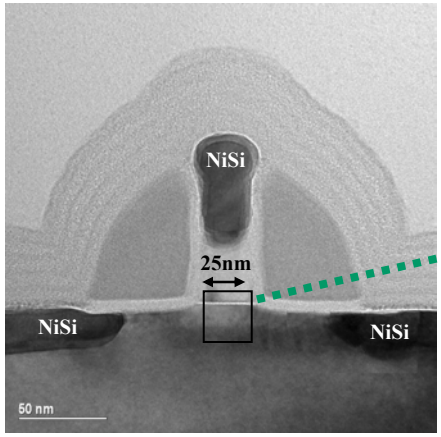
Convergence to Production – 65nm

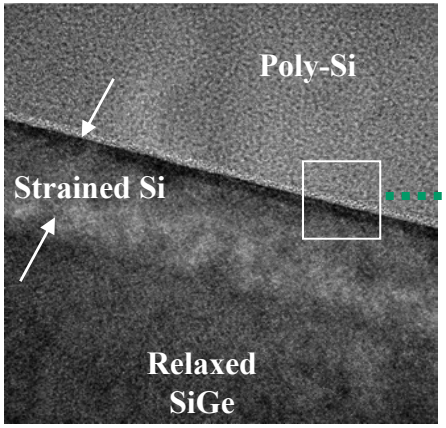
- Technology options currently under study
- Will converge over the next year to a “baseline” technology choice and process flow
- Exercise with test vehicle in ‘03, follow with product-like vehicles in ’04
- Production qualification 2H’05

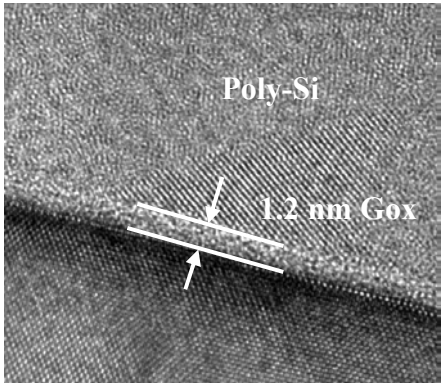
Strained-Si Transistors





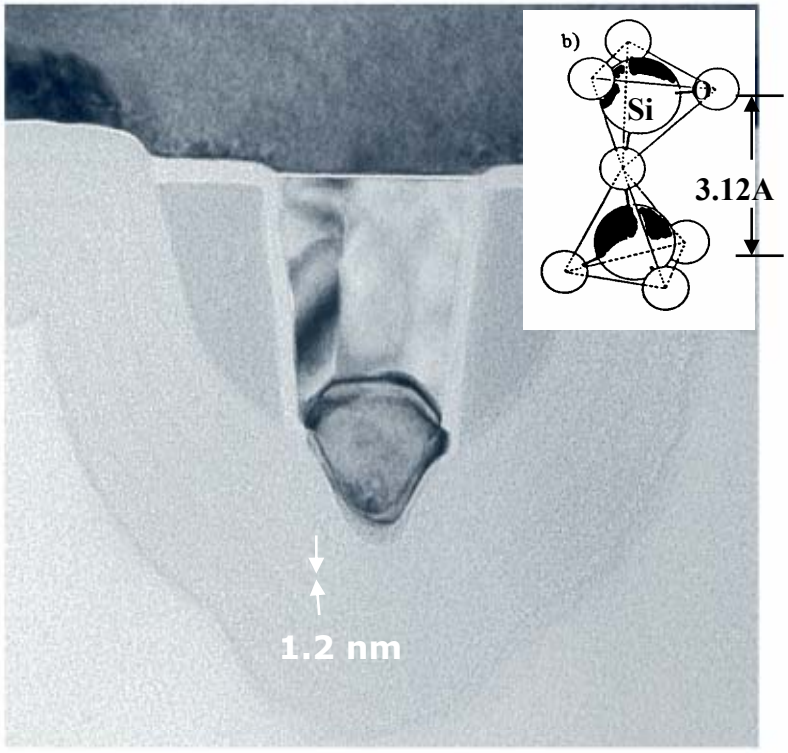


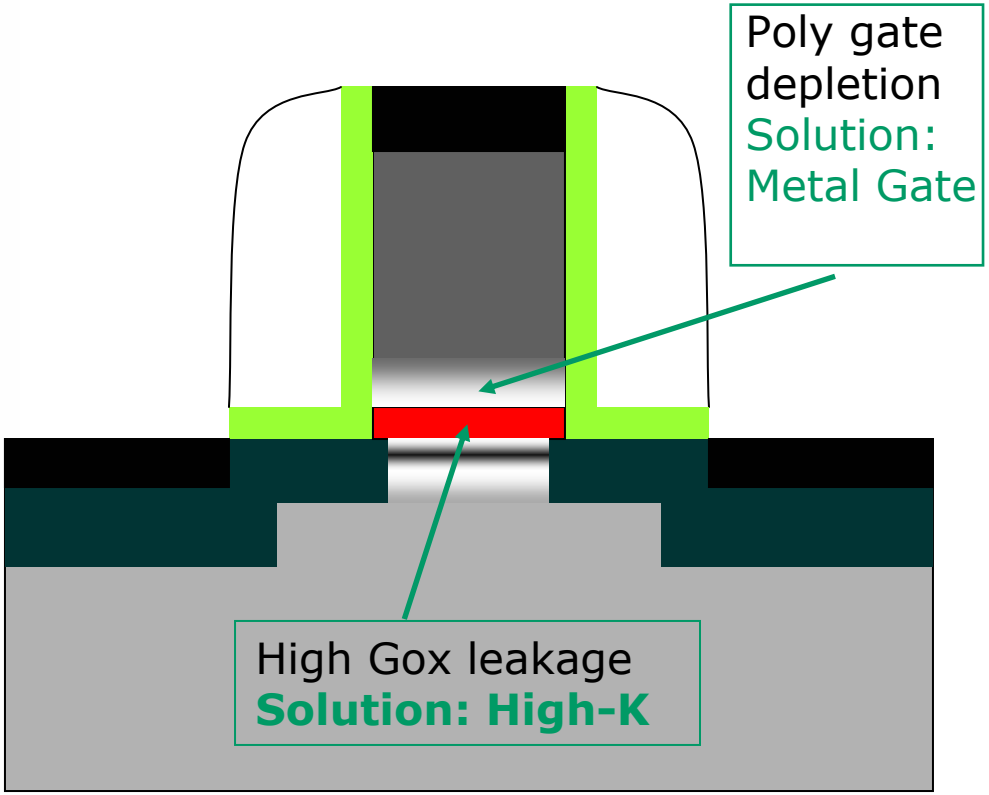




Strained substrate: 20% Ge; 175A strained Si

Is there any oxide left?

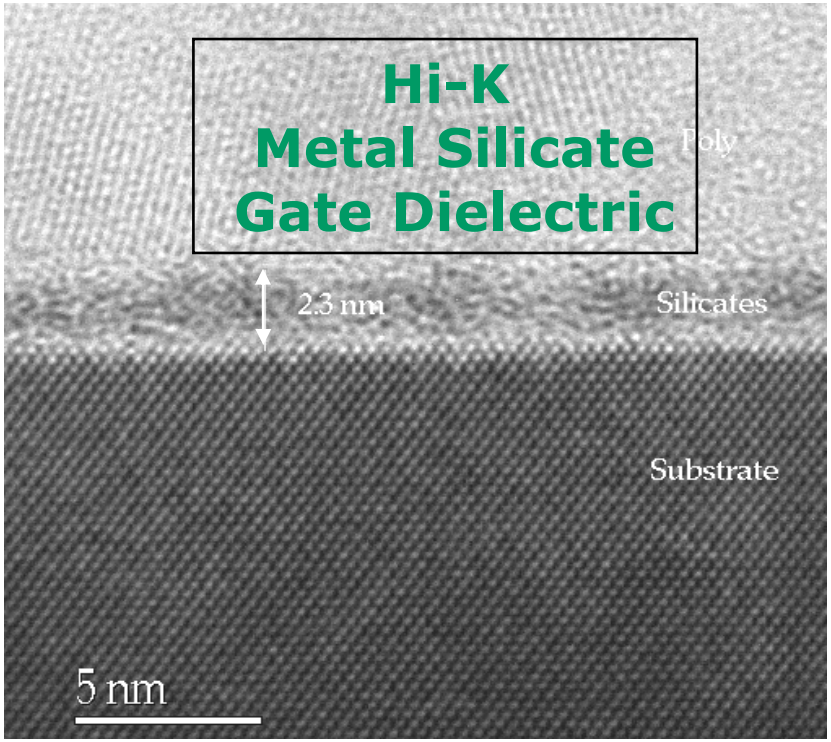


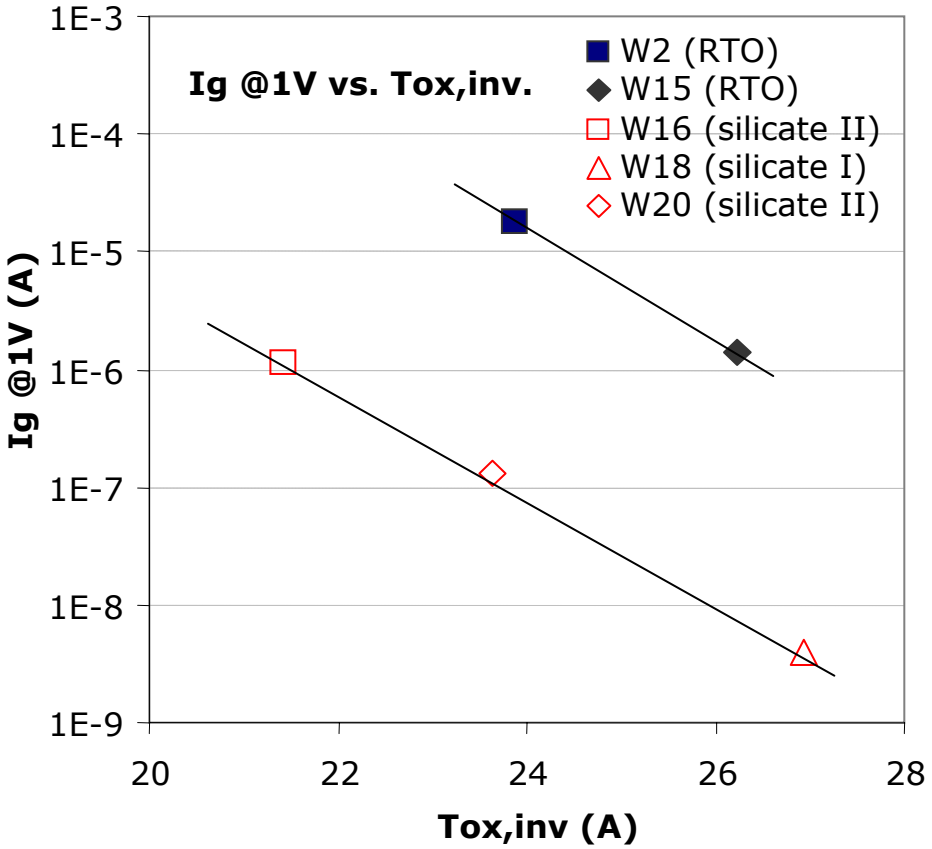


onger behaves as a good insulator

- Need to reduce gate leakage and increase gate capacitance
- High dielectric constant -> Same capacitance, but lower gate leakage

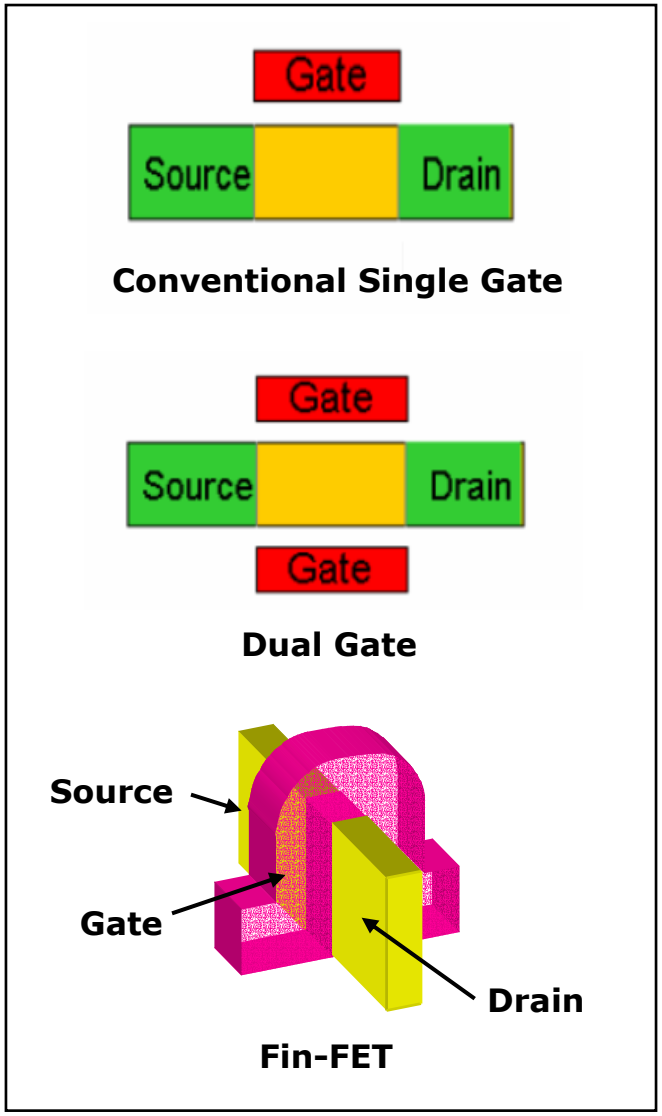
Hi-k Dielectrics

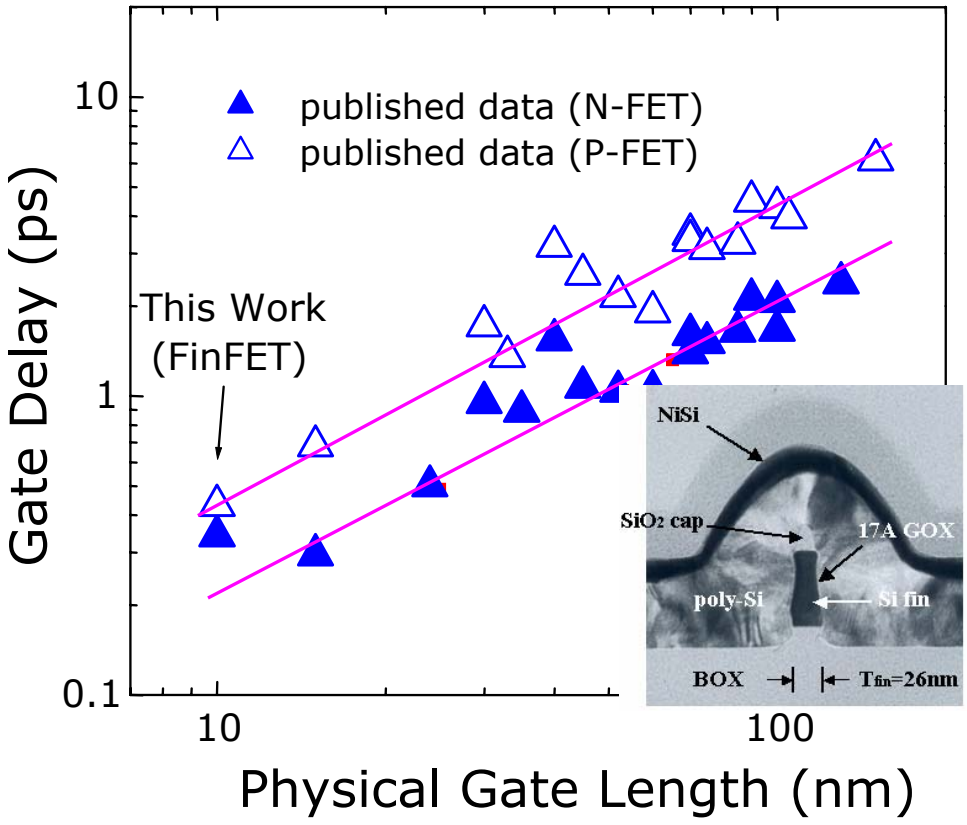




- **For the same inversion Tox, Metal-silicate show 2 order less leakage than SiO2 control**

10nm CMOS FinFETs



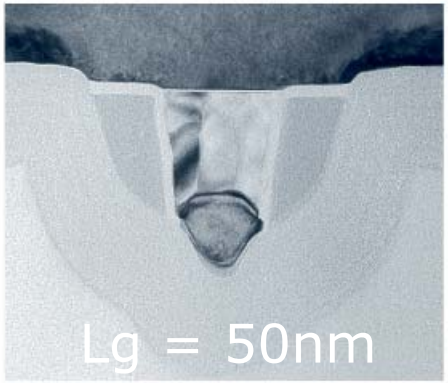


- **Good short-channel behavior**

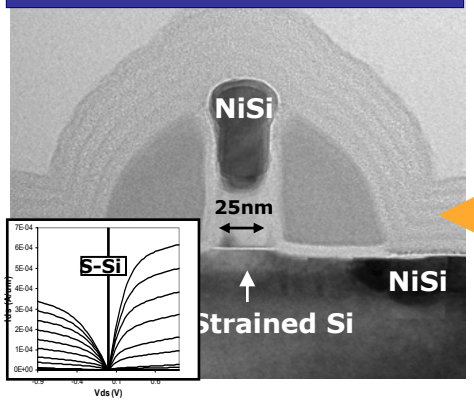
Path to < 15nm Transistors

AMD

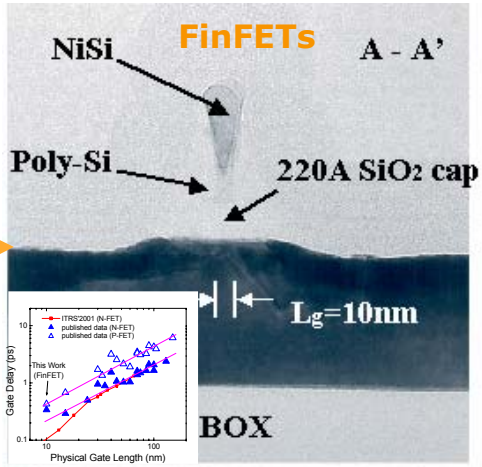
Current Practice



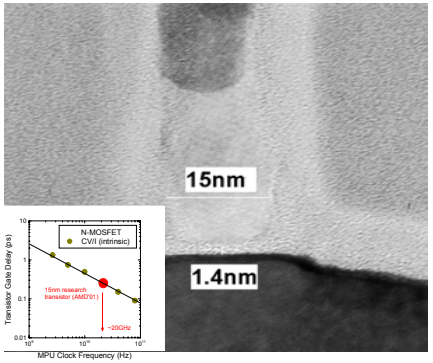
SiGe MOSFET



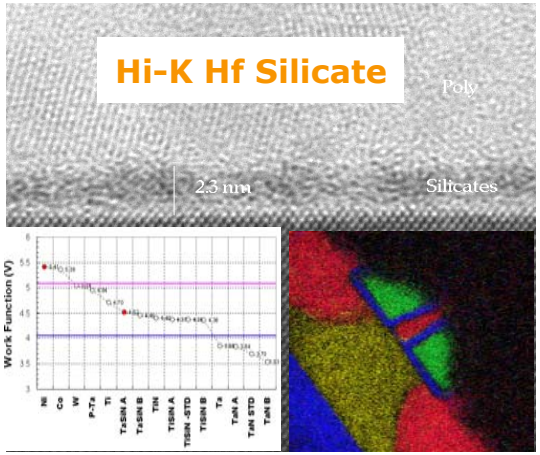
FinFETs



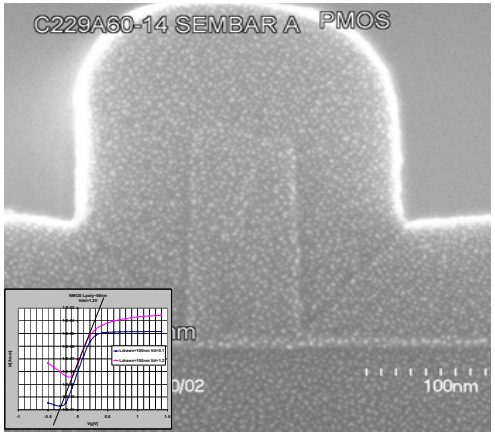
Bulk/PDSOI Aggressive Device Scaling



Hi-K Hf Silicate



Fully-Depleted SOI



Recognition of Research at AMD…
2002 IEDM Papers

- Exploratory Device Research

  "FinFET scaling to 10nm gate length" (B.Yu et al)

- Adv. Logic Research

  "Nickel silicide metal gate FDSOI devices with improved gate oxide leakage" (Z. Krivokapic, et al)

- Adv. Memory Research

  "Quantum-well Memory Device (QWMD)with Extremely Good Charge Retention" (Z. Krivokapic, et al)

- New Materials and Process Integration

  "Transistors with Dual Work Function Metal Gates by Single Full Silicidation (FUSI) of Polysilicon Gates" (W.P. Maszara, et al)

AMD U.S. Patents Issued

1998			1999			2000			2001		
	Company	No. Patents		Company	No. Patents		Company	No. Patents		Company	No. Patents
1	IBM	2,682	1	IBM	2,789	1	IBM	2,922	1	IBM	3,453
2	Canon	1,934	2	NEC	1,853	2	NEC	2,034	2	NEC	1,966
3	NEC	1,632	3	Canon	1,800	3	Canon	1,897	3	Canon	1,877
4	Motorola	1,428	4	Samsung	1,544	4	Samsung	1,442	4	Micron	1,643
5	Sony	1,321	5	Sony	1,429	5	Lucent	1,415	5	Samsung	1,451
6	Samsung	1,306	6	Fujitsu	1,231	6	Sony	1,394	6	Matsushita	1,447
7	Fujitsu	1,205	7	Toshiba	1,225	7	Micron	1,306	7	Sony	1,392
8	Toshiba	1,194	8	Motorola	1,207	8	Toshiba	1,264	8	Hitachi	1,283
9	Kodak	1,125	9	Lucent	1,156	9	Motorola	1,203	9	Mitsubishi	1,210
10	Mitsubishi	1,120	10	Mitsubishi	1,089	10	Fujitsu	1,169	10	Fujitsu	1,208
11	Hitachi	1,107	11	Matsushita	1,065	11	Matsushita	1,150	11	Toshiba	1,176
12	Matsushita	1,058	12	Hitachi	1,020	**12**	**AMD**	**1,055**	12	Lucent	1,119
13	Lucent	930	13	Kodak	993	13	Hitachi	1,046	13	GE	1,112
14	Philips	845	14	Micron	934	14	Mitsubishi	1,037	**14**	**AMD**	**1,090**
15	HP	866	15	Philips	866	15	Siemens AG	932	15	HP	982
16	Xerox	769	16	HP	855	16	HP	904	16	Philips	882
17	GE	729	**17**	**AMD**	**825**	17	Kodak	876	17	Siemens	817
18	**Intel**	**705**	**18**	**Intel**	**735**	18	Philips	839	**18**	**Intel**	**811**
19	Siemens AG	631	19	Siemens AG	731	**19**	**Intel**	**797**	19	TI	806
20	Texas Inst	618	20	GE	700	20	GE	790	20	Motorola	785
21	Sharp	611	21	Xerox	671	21	Texas Inst	692	21	Xerox	722
22	Micron	580	22	Texas Inst	604	22	Sharp	619	22	Kodak	719
	Nikon	580	23	Sharp	566	23	Xerox	577	23	Bosch	705
24	**AMD**	**560**	24	Sun Microsys	565	24	Bosch	550	24	UMC	596
25	MN Mining	557	25	Proctor & Gamble	551	25	Fuji Photo	549	25	Honda	587

Source: IFI Claims Patent Service

In Summary….

- 130nm Bulk now in full production for logic; imminent for Flash
- 130nm SOI Hammer in final qualification
- On Track for 90nm Technology Insertion
  - All equipment for initial 90nm logic is in place
  - Excellent early yields on SRAM evaluation vehicle
  - 90nm Hammer vehicle now in process
  - 90nm Flash in early development; Cu interconnect
- 65nm Development plan defined; experimental work in progress
- Research projects aimed at 45nm node and beyond
  - Logic and Flash memory


AMD

Trademark Attribution